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Change control in project of web application development in e-commerce environment

Milan Malić[1], Vesna Makitan[1] and Ivana Petrov[1]

[1] University of Novi Sad / Technical Faculty "Mihajlo Pupin", Djure Djakovica bb, 23000 Zrenjanin, Serbia
milanmalic@outlook.com; vesna@tfzr.uns.ac.rs; ivanapetrov.it@outlook.com

Abstract. In order to survive in the market and to become concurrent in modern business, companies need to accept and implement new technologies in their business processes. Internet presence enabled companies' new way of running business and presenting product/services to the clients. Using e-business, companies may collect large amount of information about their clients and partners, and after its analysis, they may create new products/services and answer effectively to the global market needs. Too many information and efficient analysis demand new data storage methods. BigData and NoSQL databases prevailed as a suitable solution. Faster data delivery, real time work and lower costs, are some of the reasons why companies begin to implement those technologies. On the other hand, uncertainty about the processes of database system change may slow down the changes. This work illustrates above-mentioned changes through change control in project of web application development in e-commerce environment. Advantages and disadvantages of the new way of data storage are presented too. Therefore this work may be used as an example in the companies that run business by e-way or are beginners in this area.

Keywords: change control, e-commerce, development, RDBMS, NoSQL.

1. Introduction

Intensive changes in the world of information technologies (IT), development of information and communication technologies (ICT), as well as growing need for new information are some of the reasons that push modern companies to make changes. As Bill Gates ones said: "Change is not an option. We cannot vote and say we want it stops. In fact, we are changing faster than ever."

It is obvious that modern business organizations, now, more than ever, need to accept new prevailing business rules, not only to conquer new markets, but also to survive in them. Expansion of IT and Internet forced companies to provide their business in e-way to the clients and partners. New technologies forced companies to adopt new ways of storing and analyzing collected data, by using information systems (IS). *The CHAOS report* [1] from 1995 stressed that only 16.2% of IT projects in the USA were completed successfully. According to this, software development projects are the most problematic and they need better project management.

It is clear that nowadays Internet became inseparable part of modern business, and companies seek for new ways of delivering products to their clients. E-market enabled new ways of product/service delivering, as well as gathering information about clients and partners for organizations that run business like this.

Due to the amount and capacity of data, classical relational database management system (RDBMS) cannot be the reasonable solution for imposed requirements. BigData and NoSQL are logical solutions in this case. According to [2] BigData represents new generation of technologies and architectures, they have design that enable economical usage of data from the big data sets, with great agility in saving, finding and/or analyzing of data.

The majority of modern business is in marketing, and Internet marketing takes more and more significant part in companies' advertisement. Tools for Internet search epmhpasise download speed. In order to satisfy standards, having search engine optimization (SEO) on company's Internet portal becomes mandatory. Teams of experts are gathered to accomplish even one millisecond faster download and to become competitive.

This work represents implementation of the new way of data storing – NoSQL, in e-commerce environment of business companies, as potential solution of nowadays requirements. Above all the advantages of this way of data storing and change and risk management as consequences of its implementation are represented as well.

Also, there are: Related work; Detailed review of change control in NoSQL database implementation in e-commerce application development; Advantages, disadvantages and risks of NoSQL implementation; Conclusion and further work.

2. Related work

E-business means usage of e-resources and platforms in running companies' business [3]. E-commerce is more specific than e-business and means that beside companies' data about its history, business politics and products, Internet portal offers possibility of on-line buying [3]. In that way e-business includes not only e-commerce, but also trading with intangible – information. It supports all the steps of classical commerce. Moreover, it includes e-services, post sales service or on-line advice.

According to Ecommerce foundation [4] over 1,200 million people bought something over Internet, at least once. It means that turnover was 1,442 billion dollars, i.e. average purchase was over 1,100 dollars. Also, the same reference implies that the greatest share in e-commerce has Asia (34.6%), Europe (31%) and North America (28.4%). It is obvious that, nowadays the great part of the market migrated in e-market, and this development is yet to come.

According to [5] only in Europe there are 2.4 million jobs related to business-to-customer (B2C) commerce. Also, there are over 715,000 active Internet portals that run some way of e-commerce with B2C connections. It is important to stress that there were over 4 billion shipment after buying product/services by e-commerce.

Abovemantioned statistics implies on importance of projects in e-business area. The amount of exchanged data between interested parties is large and significant. By storing this data, and afterwards, by its analysis, organizations may discover new data and use it in business decissions and for creating new strategies.

As it was said, organizations were forced to seek for the new data storing technologies. Centralized systems, such as Data Warehouse, are implemented in modern organizations more offen. This architecture enables integration of different databases into a unique system, with centralized data management that speed up access and data analyzing [6].

In order to find appropriate reaction to risks and problems during implementation of the new technologies for data storing, such projects need good management and change control [7]. Considering previous statistics about project management, its significance for implementation of the new technologies into existing systems is obvious.

Changes and their implementation usully have consequences [8], and change control enables projects to stay on track and in accordance with the previous developed and defined requirements. Moreover, change control means rejecting unnecessary changes or those who have minimal advantage per high price for the project.

In case of the project of web application development of company's e-business that requires changes in implemented technology for data storing, it is clear why this project need to be well controlled and managed. Changes are necessary almost for the entire segment related to communication with database that supports only application. Although it can be said with correct certainty which amount of changes is necessary for the application in total, those considering Model-View-Controller will be 100%. This is important because according to many sources changes in project should not influence on project more than 10 or 15% during risks and uncertainty that may occur and produce unsuccessful project.

On the other hand, according to [39, 10, 11, 12, 13] advantages of NoSQL comparing to RDBMS are many. One of them is real time work, which is vital for Internet searching tools, such as Google, BING and Yahoo [14]. This is one of the basic parameters that those searching tools use during ranking Internet portals on pages with resulting sets after defined searches. In this way organization may become respectable, its site may be visited more often, had better rank comparing to competition and provide new clients for the company.

3. Project realization and change control

Every change that may influence on project needs to be approved by Change Control Board (CCB). This board is usually consisted of experts, stakeholders and project sponsors who decide whether the control will be accepted and implemented or not. In literature, this board is named as "change resistance board" because the majority of changes were rejected. In information technology (IT) projects changes are usual and have great impact on risk level and uncertainty. Once uncertainty is accepted, implementation of changes may be examined from different perspectives [14]: enabling change is more important than change control; to become better in rework is virtue; change control is the best if focuses final product components; backup information must be implemented on every development level; enabling change demands processes on many levels.

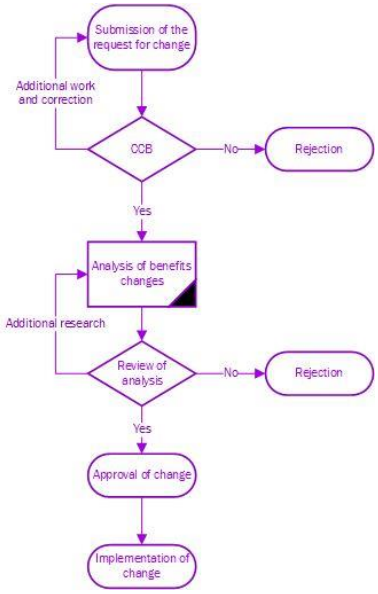

Fig 1. Steps in accepting change request.

Considering that implementation of the new way of data storing, such as NoSQL, demands changes on several levels, starting with applicative ones, to the storing systems, those changes had to be observed as processes at many levels. In order to accept change request it has to pass several phases illustrated in the figure 1. The first step in change request acceptance is its submission to the CCB for revision. The request may be rejected, reworked or accepted. In case of acceptance CCB requests detailed analysis and exploring its advantages. After this, change request may be rejected, reworked or accepted. Accepted change request means approval of changes and its implementation in project plan. The document about change request that CCB gets has basic information about the change, as it may be seen in the figure 2a. The CCB reply should be the final decision (figure 2b) no matter on its consequences.

Submitter – Basic info	
No.:	Change description:
Submitter:	Reasons of change:
Submission date:	
Reply to:	Business justification:
Priority:	
Expected results:	

(a)

CCB reply on the change request document			
Decision:	Yes	No	Amendment
Decision date:	Signature:		

(b)

Fig 2. (a) Change request document; **(b)** Change request approval/disapproval document.

According to the CCB reply document, change request is further processed or rejected. In case of change request acceptance, the next step is analyzing and exploring change influence and impact on project. In this phase experts should be included in order to gather reliable information. Beside change advantages, experts should stress risks. This will enable the right contingency plan in case of undesirable situations.

Figure 3 represents the document with information about the risk.

<table>
<tr><td>No: number</td><td colspan="2">Risk: Descriptive risk name</td></tr>
<tr><td>Priority: integer</td><td colspan="2" rowspan="3">Description: Detailed risk description</td></tr>
<tr><td>Probability: low/medium/high</td></tr>
<tr><td>Influence: low/medium/high</td></tr>
<tr><td>Origin: the cause of the risk</td><td>Class: technology/resource/3rd party</td><td>Assigned: employee</td></tr>
<tr><td colspan="2">Possible replies:</td><td>Primary reply:</td></tr>
<tr><td colspan="3">Strategy: which strategy will enable risk elimination</td></tr>
<tr><td colspan="3">Actions: what has to be done to fulfill the strategy</td></tr>
<tr><td colspan="3">Contingency plan: creating plans in case of primary strategy failure</td></tr>
<tr><td colspan="2">Status:</td><td>Date:</td></tr>
<tr><td>Approved by:</td><td>Date:</td><td>Reason:</td></tr>
</table>

Fig 3. A document including information about the risk.

After the change request revision and after analysis of related research about the change follows revision of gathered research. If change request appears justified and its implementation is reasonable, CCB approves the change and its implementation in project plan. Otherwise, if the change does not improve project and may influences project failure, it will be rejected and project will continue with previously defined plan.

	Task Mode	Task Name	Duration	Start	Finish	Predec
1		**Disscusion about the project**	**2.75 days**	**Wed 04-05-16**	**Fri 06-05-16**	
8		Kickoff meeting	2 hrs	Fri 06-05-16	Fri 06-05-16	1
9		**Web application development**	**34.88 days**	**Mon 09-05-16**	**Fri 24-06-16**	**8**
42		**Web application programming**	**14.38 days**	**Fri 24-06-16**	**Fri 15-07-16**	**9**
141		**Testing**	**1 day**	**Fri 15-07-16**	**Mon 18-07-16**	**42**
144		**Documentation**	**9 days**	**Mon 18-07-16**	**Fri 29-07-16**	**141**
152		Training	2 days	Fri 29-07-16	Tue 02-08-16	144
153		Application installing	0 days	Tue 02-08-16	Tue 02-08-16	152
154		**Support and maintenance**	**74.75 days**	**Tue 02-08-16**	**Mon 14-11-16**	**153**
167		**Project closure**	**2.5 days**	**Tue 15-11-16**	**Thu 17-11-16**	**154**

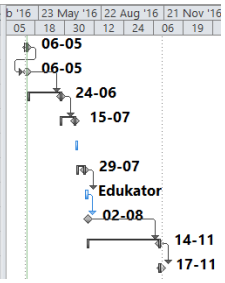

Fig 4. Project plan after implementation of changes.

Changes that concern NoSQL implementation in e-commerce environment are many, but also advantages that they bring with them. This will be discussed later in this paper. After the change approval it should be implemented into the project, and determined, what actions need to be done, in order to implement the change completely. It should be

stressed that moving from classical RDBMS to NoSQL brings changes on many levels, and every one of them should be controlled and monitored. In order to accomplish the previous it is necessary to create journals that will be the main reference when error occurs. Also, it is important to stress that only those changes that influence on final project result or change project course need CCB approval.

In order to support project management and change control there are project management software (Microsoft Project 2016 was used in this work). Figure 4 represents project plan after the changes caused by implementation of the new storing system. Because of the changes and uncertainty that they bring it is important to implement techniques represented in this work to minimize the risk and enable efficient management.

4. Project results

Implementation of NoSQL in e-commerce systems brings many advantages, but also uncertainty. Thanks to IT project management and change control it is possible to control risks that occur during change implementation. Although this process is risky, the advantages it brings are countless, starting with query implementation through program code to many direct or indirect savings that company gets.

Comparing project plan from previous section implies on time savings, as well as resources during web application development. Implementation of this storing system in modern applications becomes usual because it is faster and easier and brings advantages concerning maintenance and future application development. Flexible scheme that supports NoSQL enables developers to make changes in database at any time. Also, NoSQL database does not requires new highly sophisticated hardware, and in that way enables savings concerning equipment for system storing. Modern servers that support large RDBMS cost over tens of thousands of dollars, while NoSQL systems may have lower class servers by lower price. Some of the advantages of NoSQL databases are: scalability, availableness, low hardware requirements, flexible scheme, big data, object oriented programming, performances, failure control, less administration, asynchronous replication with auto-failover, cloud implementation... The change of complete system is not always the best solution and CCB may decide to change only one segment of the system that will bring expected results. In this case, application code should have separate modules for accessing and data processing to both, RDBMS and NoSQL. Some of the cases that enable usage NoSQL and RDBMS together are: storing aggregation queries results, archiving data, creating journals, storing entities of metadata.

5. Conclusion and further work

In this work change control in project of web application development in e-commerce environment, concerning implementation of the new storing system was presented. Change control is very demanding and involves total commitment of project manager. Many risks that may occur are some of the reasons why CCB disapproves

changes. On the other hand organization that accepts the challenge may become competitive. Also, this work showed the way of overcoming mistakes during changes and efficient risk management. Advantages of NoSQL databases are many and some of them are savings in: hardware features, application code development time, replication data support, flexible scheme, performances, availability, etc. NoSQL application in e-commerce environment is needed for modern organization development. This is because sensor networks in modern industry and management, and environment like building management system (BMS) demand NoSQL storing system. That is why future project management should follow the steps of modern business organizations and industry.

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